

ABSTRACT OF THE INVENTION

A Lanthanum Halide scintillator (for example LaCl_3 and LaBr_3) with fast decay time and good timing resolution, as well as high light output and good energy resolution, is used in the design of a PET scanner. The PET scanner includes a cavity for accepting a patient and a plurality of PET detector modules arranged in an approximately cylindrical configuration about the cavity. Each PET detector includes a Lanthanum Halide scintillator having a plurality of Lanthanum Halide crystals, a light guide, and a plurality of photomultiplier tubes arranged respectively peripherally around the cavity. The good timing resolution enables a time-of-flight (TOF) PET scanner to be developed that exhibits a reduction in noise propagation during image reconstruction and a gain in the signal-to-noise ratio. Such a PET scanner includes a time stamp circuit that records the time of receipt of gamma rays by respective PET detectors and provides timing data outputs that are provided to a processor that, in turn, calculates time-of-flight (TOF) of gamma rays through a patient in the cavity and uses the TOF of gamma rays in the reconstruction of images of the patient.